WHAT IS CLAIMED IS:

1. An *n*-type diamondoid material comprising an electron-donating heteroatom.

2. The *n*-type diamondoid material of claim 1, wherein the electron-donating heteroatom is a group V element.

3. The *n*-type diamondoid material of claim 1, wherein the electron-donating heteroatom is selected from the group consisting of nitrogen, phosphorus, and arsenic.

4. The *n*-type diamondoid material of claim 1, wherein the material comprises an aza-diamondoid.

5. The *n*-type diamondoid material of claim 1, wherein the electron-donating heteroatom occupies a substitutional site on the diamond lattice.

6. The *n*-type diamondoid material of claim 1, wherein the electron-donating heteroatom is sp^3-hybridized in the diamond lattice.

7. The *n*-type diamondoid material of claim 1, wherein the diamondoid is selected from the group consisting of adamantane, diamantane, and triamantane.

8. The *n*-type diamondoid material of claim 1, wherein the diamondoid is selected from the group consisting of tetramantane, pentamantane, hexamantane, heptamantane, octamantane, nonamantane, decamantane, and undecamantane.

9. The *n*-type diamondoid material of claim 1, wherein the material is a polymerized heterodiamondoid.

10. The polymerized heterodiamondoid material of claim 9, further including a metal atom to enhance electrical conductivity.

11. The polymerized heterodiamondoid material of claim 10, wherein the metal is gold.

12. A *p*-type diamondoid material comprising an electron-withdrawing heteroatom.

13. The *p*-type diamondoid material of claim 12, wherein the electron-withdrawing heteroatom is a group III element.

14. The *p*-type diamondoid material of claim 12, wherein the electron-withdrawing heteroatom is selected from the group consisting of boron and aluminum.

15. The *p*-type diamondoid material of claim 12, wherein the material comprises an boro-diamondoid.

16. The *p*-type diamondoid material of claim 12, wherein the electron withdrawing heteroatom occupies a substitutional site on the diamond lattice.

17. The *p*-type diamondoid material of claim 12, wherein the electron withdrawing heteroatom is sp^3-hybridized in the diamond lattice.

18. The *p*-type diamondoid material of claim 12, wherein the diamondoid is selected from the group consisting of adamantane, diamantane, and triamantane.

19. The *p*-type diamondoid material of claim 12, wherein the diamondoid is selected from the group consisting of tetramantane, pentamantane, hexamantane, heptamantane, octamantane, nonamantane, decamantane, and undecamantane.

20. The *p*-type diamondoid material of claim 12, wherein the material is a polymerized heterodiamondoid.

21. The polymerized heterodiamondoid material of claim 20, further including a metal atom to enhance electrical conductivity.

22. The polymerized heterodiamondoid material of claim 21, wherein the metal is gold.

23. An electrical *p-n* junction comprising a *p*-type diamondoid material and an *n*-type diamondoid material.

24. The *p-n* junction of claim 23, wherein the *n*-type diamondoid material is aza-heterodiamondoid.

25. The *p-n* junction of claim 23, wherein the *n*-type diamondoid material is phospho-heterodiamondoid.

26. The *p-n* junction of claim 23, wherein the *p*-type diamondoid material is boro-heterodiamondoid.

27. A diamondoid transistor comprising an *n*-type heterodiamondoid material and a p-type diamondoid material.

28. The diamondoid transistor of claim 27, wherein the transistor comprises an *n-p-n* field effect transistor.

29. The diamondoid transistor of claim 27, wherein the transistor comprises an *p-n-p* field effect transistor.

30. The diamondoid transistor of claim 27, wherein the *n*-type diamondoid material is aza-heterodiamondoid.

31. The diamondoid transistor of claim 27, wherein the *n*-type diamondoid material is phospho-heterodiamondoid.

32. The diamondoid transistor of claim 27, wherein the *p*-type diamondoid material is boro-heterodiamondoid.

33. The diamondoid transistor of claim 27 further comprising a source, gate, and drain, wherein the source and drain are frabricated from the *n*-type heterodiamondoid material, and the gate is fabricated from the *p*-type diamondoid material.

34. The diamondoid transistor of claim 27 further comprising a source, gate, and drain, wherein the source and drain are frabricated from the *p*-type heterodiamondoid material, and the gate is fabricated from the *n*-type diamondoid material.

35. A method of synthesizing an *n*-type diamondoid material, the method comprising:

a) photo-oxidizing a diamondoid to form a hydroxy-diamondoid;

b) chemically oxidizing a diamondoid to a keto-diamondoid;

c) reducing the keto-diamondoid to a hydroxy-diamondoid;

d) preparing an aza-diamondoid-ene from the hydroxy-diamondoid;

e) preparing an epoxy aza-diamondoid from the aza-diamondoid-ene;

f) preparing an aza-diamondoid from the aza-diamondoid-ene.

36. A method of synthesizing an *n*-type diamondoid material, the method comprising:

a) chemically oxidizing a diamondoid to a keto-diamondoid;

b) preparing a fragmented diamondoid carboxylic acid from the keto-diamondoid;

c) preparing a fragmented diamondoid-ene acetate from the fragmented diamondoid carboxylic acid;

d) preparing a fragmented hydroxy-diamondoid-ene by reducing the fragmented diamondoid-ene acetate;

e) preparing a fragmented keto-diamondoid-ene by oxidizing the fragmented hydroxy-diamondoid-ene;

f) preparing a fragmented diamondoid=N-OH-ene from the fragmented keto-diamondoid-ene;

g) preparing an aza-diamondoid from the fragmented diamondoid=N-OH-ene.

37. A method of preparing an *n*-type diamondoid material, the method comprising:

a) isolating a diamondoid from a petroleum feedstock using a distillation, heat treatment, and separation technique;

b) converting the diamondoid into a heterodiamondoid by substitutionally positioning an electron donating heteroatom on a diamond crystal lattice position.

38. A method of preparing an *p*-type diamondoid material, the method comprising:

a) isolating a diamondoid from a petroleum feedstock using a distillation, heat treatment, and separation technique;

b) converting the diamondoid into a heterodiamondoid by substitutionally positioning an electron withdrawing heteroatom on a diamond crystal lattice position.

39. A diamondoid transistor comprising a substantially single material, the transistor comprising electrically conducting regions and electrically insulating regions, wherein:

the electrically conducting regions of the transistor comprise *n* and *p*-type heterodiamondoid materials; and

the electrically insulating regions of the transistor comprise undoped diamondoid materials.

40. The transistor of claim 39, wherein the *n*-type diamondoid material comprises aza-heterodiamondoid.

41. The transistor of claim 39, wherein the *n*-type diamondoid material comprises phospho-heterodiamondoid.

42. The transistor of claim 39, wherein the *p*-type diamondoid material comprises boro-heterodiamondoid.